

RECEIVED CENTRAL FAX CENTER

333 W. San Carlos Street Suite 600 San Jose, CA 95110-2731 408.975.7500 Fax 408.975.7501

DEC 1 8 2006

Fax Transmission

From:

Sumit Bhattacharya

Date:

December 18, 2006

Direct Dial:

408.975.7950

Fax:

408.975.7501

Docket Number:

2207/9800

Total number of pages:

18

(including cover)

Please deliver to:

Name	Company	Fax	Phone
	U.S. Patent and Trademark Office	571.273.8300	

Message:

Application No.

09/708,722

Confirmation No. 2194

Applicant

Stephen J. JOURDAN et al.

Filed

November 9, 2000

Title

INSTRUCTION SEGMENT RECORDING SCHEME

TC/A.U.

2183

Examiner

Aimee J. LI

PAPER(s) ENTITLED:

Fee Transmittal (plus 1 copy)

2 pages

Appeal Brief

15 pages

74734.1

Original will not follow 🔲 Original will follow by	Regular Mail	Overnight Delivery	Hand Delivery
--	--------------	--------------------	---------------

The information contained in this facsimile transmission, including any attachments, is subject to the attorney-client privilege, the attorney work product privilege or is confidential information intended only for the use of the named recipient. If the reader of this Notice is not the intended recipient or the employee or agent responsible for delivering this transmission to the intended recipient, you are hereby notified that any use, dissemination, distribution or copying of this communication is strictly prohibited. If you have received this transmission in error, please notify us immediately by telephone, so that we may arrange for its return or destruction at our cost. Thank you.

KENYON KENYON

RECEIVED CENTRAL FAX CENTER

14089757501

.02 🗻

DEC 108. 2006and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

FEE TRANSMITTAL		Complete if Known							
		-	Application Number 09/708,722						
for FY 2006							ember 9, 2000		
Effective 10/01/2004. Patent fees ere subject to ennual revision	n.	_		ad Inve	ntor		hen J. JOURDAN et al.		
Applicant claims small entity status. See 37 CFF		<u> </u>	aminer	Name	\dashv		e J. LI		
		-	Art Unit 2183				0000		
TOTAL AMOUNT OF PAYMENT (\$) 500.00		Att	torney l	Docket I	No.	2207	/9800		
METHOD OF PAYMENT (check all that apply)							E CALCULATION (continued)		
☐ Check ☐ Credit card ☐ Money ☐ Other ☐ None Order		11	3. AD	DITIO	NAL F	EES	· · ·		
Deposit Account:	,		Large Entity Small Entity						
Deposit Account 11-0600			Foe Code	Feo (\$)	Fee Code	Fee (\$)	Fee Description Fee	Paid	
Number			1051	130	2051	65	Surcharge - late filling fee or oath		
Deposit Account Kenyon & Kenyon LLP	\neg		1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet.		
Name Reliyon & Reliyon LLP		ŀ	1053	130	1053	130	Non-English specification		
The Director is authorized to: (check all that apply)			1812	2,520	1812	2,520	For filing a request for ex parte reexamination		
Charge fee(s) indicated below Coredit any overpayments Charge any additional fee(s) or any underpayment of fee(s)			1804	920,	1804	920*	Requesting publication of SIR prior to Examiner action		
☑ Charge fee(s) indicated below, except for the filing fee to the above-identified deposit account.			1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action		
FEE CALCULATION			251	120	2251	60	Extension for reply within first month		
1. BASIC FILING FEE	•		252 253	450 1,020	2252 2253	225 510	Extension for reply within second month		
Large Entity Smell Entity			254	1,590	2254	795	Extension for reply within third month Extension for reply within fourth month	\vdash	
Fee Fee Fee Fee Description Code (\$) Code (\$) Fee Fee Description	Paid	ŀ	255	2.160	2255	1,080	Extension for reply within fifth month		
1001 790 2001 395 Utility filing fee		1	40t	500	2401	250	Notice of Appeal		
1002 350 2002 175 Design flang fee		1 1	402	500	2402	250	Filing a brief in support of an appeal	500.00	
1003 550 2003 275 Plant filing fee	<u> </u>		403	1,000	2403	500	Request for oral hearing		
1005 160 2005 80 Provisional filling tee			451 452	1,510	1451 2452	1,510 250	Petition to institute a public use proceeding Petition to revive — unavoidable	$igwdate{}$	
SUBTOTAL (1) (5)	0		453	1,500	2453	مبد 750	Petition to revive - unintentional	\vdash	
2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE		ļ,	501	1,400	2501	685	Utility issue fee (or reissue)	\vdash	
Fan ham	ĺ	ŀ	502	490	2502	245	Design issue fee		
Extra Claims below Fee Paid		1 1	503	660	2503	330	Plant issue fee		
Total Claims = X 60.00 =		1	460 807	130	1460 1807	130 50	Petitions to the Commissioner		
= X 200.00 -			806	180	1806	180	Processing fee under \$7 CFR 1.17 (q) Submission of Information Diactosure Stret	\vdash	
Multiple X =			021	40	8021	40	Recording each patent assignment per property (times number of properties)		
Large Entity Small Entity		1	809	790	2809	396	Filing a submission after final rejection	 	
Fee Code (\$) Fee Description		╽,	810	790	2810	395	(37 CFR § 1.129(a)) For each additional invention to be		
1202 50 2202 25 Claims in excess of 20 1201 200 2201 100 Independent claims in excess of	13						examined (37 CFR § 1.129(b))		
1209 360 2203 180 Multiple dependent claim, if not p	paid	1	801	790	2801	395 I	Request for Continued Examination (RCE)		
1204 200 2204 100 ** Reissum independent claims of original patent	1	1	802	900	1802		Request for expedited examination		
1205 50 2205 25 ** Reissue dalme in excess of 2 over original patent	D and	1	3 45.4	ا ز_			of a design application	\vdash	
SUBTOTAL (2) (5)	SUBTOTAL (2) (5) Other fee (specify)					-			
**or number previously peld, if greater, For Reissues, see above				Reduced by Basic Filing Fee Paid SUBTOTAL (3) (\$) 500.00					
SUBMITTED BY		_			-		Complete // assissable)		
Name (Print/Type) Sumit Bhattacharya Rafistration No. (R.			M/Anne	, 5	1,46	9	Comptete (if sopticable) Telaphone (408) 975-7500		
Signature Van to			or a straightfully				Dete December 16,		
WARNING: Information on this		_			· • · · · · · · · · · · · · · · · · · ·		December 16,		
Included on this form. Provide in collection of information is required by 37 CFR 1.17 and 1.27, obtains. Confidentiality is governed by 35 U.S.C. 122 and 37 of prieted application. Confidentiality is governed by 35 U.S.C. 122 and 37 of prieted application form to the USPTO. Time will vary depending their placetion form to the USPTO. The will vary depending their placetion of the USPTO. The will vary depending their placetion form to the USPTO. The will vary depending their placetion form to the USPTO. Fax No. In the Confidential their placetic placeting facilities that this paper is being facsimile transmitted to the USPTO, Fax No. In the Confidential transmitted to the USPTO, Fax No. In the Confidential transmitted to the USPTO, Fax No. In the Confidential transmitted to the USPTO, Fax No. In the Confidential transmitted to the USPTO, Fax No. In the Confidential transmitted to the USPTO, Fax No. In the Confidential transmitted to the USPTO, Fax No. In the Confidential transmitted to the USPTO, Fax No. In the USPTO, F									

Patent

Attorney Docket No.: Intel 2207/9800

Assignee: Intel Corporation

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT

Stephen J. JOURDAN et al.

RECEIVED CENTRAL FAX CENTER

SERIAL NO.

09/708,722

DEC 1 8 2006

FILED

November 9, 2000

FOR

INSTRUCTION SEGMENT RECORDING SCHEME

GROUP ART UNIT

2183

EXAMINER

Aimee J. LI

M/S: APPEAL BRIEF - PATENTS

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being facsimile transmitted to the United States Patent and Trademark Office via facsimile number: (571) 273-8300 or deposited with the United States Postal Service as first class mail in an envelope addressed to: M/S: APPBAL BRIEF - PATENTS, Commissioner for Fatents, P.O. Box 1450,

Alexandria, VA 22313-1450 on

Dated: December 16, 2006

Dilas Davisianas

ATT

ഹ്oard of Patent Appeals and Interferences

APPEAL BRIEF

Dear Sir:

This brief is in furtherance of the Notice of Appeal, filed in this case on October 16,

2006.

12/19/2006 MGEBREM1 00000119 110600

09708722

01 FC:1402

500.00 DA



DEC 1 8 2006

1. REAL PARTY IN INTEREST

The real party in interest in this matter is Intel Corporation. (Recorded November 9, 2000; Reel/Frame 011535/0333).

2. RELATED APPEALS AND INTERFERENCES

There are no related appeals.

3. STATUS OF THE CLAIMS

Claims 1-19 are pending in the application. Claims 1, 3-8, 12-15 and 17-19 are rejected under 35 U.S.C. §103(a) as being unpatentable over Patel et al., *Improving Trace Cache Effectiveness with Branch Promotion and Trace Packing*, in further view of Johnson, U.S. Patent No. 5,924,092. Claims 2, 9-11 and 16 are rejected under 35 U.S.C. §103(a) as being unpatentable over Patel, in further view of Johnson, in further view of Peled et al., U.S. Patent No. 6,076,144.

4. STATUS OF AMENDMENTS

The claims listed on page A-1 of the Appendix attached to this Appeal Brief reflect the present status of the claims.

5. SUMMARY OF THE CLAIMED SUBJECT MATTER

The embodiment of claim 1 generally describes a cache comprising: a cache line to store an instruction segment (see e.g., page 5, lines 4-7 – Figure 2, 210) further comprising a plurality

of instructions stored in sequential positions of cache line in reverse program order (see e.g., page 5, lines 23-24).

The embodiment of claim 5 generally describes a segment cache for a front-end system in a processor (see e.g., page 5, lines 4-7 – Figure 2, 210), comprising a plurality of cache entries to store instructions of instruction segments in reverse program order (see e.g., page 5, lines 21-24 – Figure 2, 210 and Figure 4, 440).

The embodiment of claim 8 generally describes a method comprising building an instruction segment based on program flow (see e.g., page 5, lines 14-15), and storing instructions of the instruction segment in a cache entry in reverse program order (see e.g., page 5, lines 21-24 – Figure 2, 210 and Figure 4, 440).

The embodiment of claim 14 generally describes a processing engine, comprising: a front end stage to build and store instruction segments (see e.g., page 4, lines 3-12 – Figure 2, 200), instructions provided therein in reverse program order (see e.g., page 5, lines 21-24 – Figure 2, 210 and Figure 4, 440), and an execution unit in communication with the front end stage (see e.g., page 4, lines 10, 17, 22 and 24).

FIG. 1 is a block diagram illustrating the process of program execution in a conventional processor. FIG. 2 is a block diagram of a front end processing system according to an embodiment of the present invention. FIG. 3 is a block diagram of a segment cache according to an embodiment of the present invention. FIG. 4 illustrates a relationship between exemplary segment instructions a cache bank according to the embodiments of the present invention.



6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

- A. Are claims 1, 3-8, 12-15 and 17-19 unpatentable over Patel et al., Improving

 Trace Cache Effectiveness with Branch Promotion and Trace Packing, in further view of

 Johnson, U.S. Patent No. 5,924,092?
- B. Are claims 2, 9-11 and 16 unpatentable over Patel et al., *Improving Trace Cache Effectiveness with Branch Promotion and Trace* Packing, in further view of Johnson, U.S. Patent No. 5,924,092, in further view of Peled et al., U.S. Patent No. 6,076,144?

7. ARGUMENT

A. Claims 1, 3-8, 12-15 and 17-19 are <u>not</u> unpatentable over Patel in further view of Johnson.

Applicants submit the cited references do not teach, suggest or disclose at least "[a] cache comprising: a cache line to store an instruction segment further comprising a plurality of instructions stored in sequential positions of the cache line in reverse program order" (e.g., as described in claim 1)

The Examiner asserts that it would be obvious to modify the instruction segment of Patel with the teaching of Johnson in order to store instructions of an instruction trace in reverse order "so that the frequently accessed and modified head of the trace will be moved and modified fewer times so that performance is improved." See Office Action dated 6/16/2006, paragraph 6.

Applicants respectfully disagree. Applicants submit in order to establish prima facie obviousness, there must be some suggestion or motivation to modify the reference or combine the reference teachings. For at least the following reasons, there is no such suggestion or motivation here.

Patel discloses the improvement of fetch rates in trace caches by employing branch promotion and trace packing. Branch promotion removes the overhead resulting from dynamic branch prediction by applying static branch prediction to strongly biased branches. Trace packing packs as many instructions as possible into a pending trace so that more instructions segments may be fetched during a single fetch cycle. However, Patel neither teaches nor suggests that the fetch rates may be improved by reversing the order of the instructions in the traces. Applicants submit there would be no motivation to do so, since reversing instruction order would not appear to improve fetch rates given the teaching of Patel.

By definition, a trace is a sequence of dynamically executed instructions, which may originally reside in non-continuous portions of the program memory, starting with a single entry instruction and ending with multiple exit instructions. For a typical trace, the head of the trace, *i.e.*, the first instruction in a sequence, is followed by the next executable instruction in the sequence, then the next, and so on. If the Examiner's assertions (discussed above) are correct, the first instruction is accessed and modified more than the second, third, etc., instructions. This is contrary to the known operation of the typical trace.

Applicants submit it is unclear how accessing the first instruction in a trace more frequently than the second instruction, and accessing the second instruction more frequently than the third, and so on, would improve the performance of a trace (thereby eliminating any motivation to do so). Since the trace defines sequential instructions, which perform a particular operation, accessing the instructions in decreasing frequency would in no way advance the completion of the particular operation. Indeed, such access of the trace would hinder the completion, thereby defeating the purpose of the trace.

Moreover, it is unclear how modifying the first instruction in a trace more frequently than the second instruction, and modifying the second instruction more frequently than the third, and so on, would improve the performance of a trace. Again, since the trace defines sequential instructions, which perform a particular operation, modifying the instructions in decreasing frequency would in no way advance the completion of the particular operation. Indeed, such modification would result in a different operation, thereby, defeating the purpose of the trace.

Therefore, the Examiner's asserted motivation for modifying Patel with Johnson does not apply.

Furthermore, even if the head of the trace could be more frequently accessed and modified, the Examiner has provided no explanation of how such would improve the fetch rates of the trace cache of Patel.

As stated previously, there is no motivation to reverse the instructions in a Patel trace. Patel discloses using branch promotion to improve cache fetch rates. The purpose of branch promotion is to reduce the dynamic branching of strongly biased traces by applying static branches (or predictions). Applicants submit reversing the instructions so that the first instruction is listed last in the trace does not improve the branch promotion technique. Reversing the instructions does not reduce the dynamic branching of strongly biased traces. Moreover, it does not improve the fetch rates. As such, there is no reason a person of ordinary skill in the art would be motivated to reverse the instructions in a trace, while using branch promotion, to improve fetch rates.

Patel also discloses using trace packing to improve cache fetch rates. The purpose of trace packing is to increase the number of instructions fetched per fetch cycle. However, Applicants submit reversing the instructions so that the first instruction is listed last in the trace does not improve the trace packing technique. Moreover, such does not appear to improve the

fetch rates. As such, a person of ordinary skill in the art would not be motivated to reverse the instructions in a trace, while using trace packing, to improve fetch rates.

Applicants further respectfully disagree with the Examiner's assertion that Johnson has taught that the static sorting algorithm stores elements in reverse order, since it stands to reason that the elements first added to the array would be accessed and used before the elements most recently added to the array. See Office Action dated 12/2/2005, page 11, paragraph 43, lines 1-3. Applicants disagree with the assertion and the associated rationales are found in paragraph 43. Applicants note the Examiner does not cite to any specific section of Johnson to support its assertion. See Office Action dated 6/16/2006, paragraph 40. Therefore, Applicants submit the claim that Johnson provides a motivation to combine its teaching with Patel is unsupported and erroneous.

However, previously in discussing Johnson, the Examiner cited column 4, lines 13-24.

Column 4, lines 13-24 of Johnson state:

For the illustrated embodiment discussed below, a static sorting algorithm is used which arranges the logical blocks of data in a logical page in reverse order, thereby placing the last logical block at the beginning of the array, and the first logical block at the end. Consequently, the more frequent modifications to the data in the first logical block require recompression and/or moving of fewer, or no other, subsequent frames than the less frequent modifications to the data in the last logical block of a page. In general, this results in a lower average number of updated frames per data modification, and thus improved overall performance. (emphasis added)

The cited section discusses improving overall performance based upon lowering the average number of update frames per modification in a data array. The cited section does not, however, discuss improving overall performance during accessing or using data in a data array. Accessing data or using data is not the same as modifying data. Modifying may be characterized as writing new data over old data in a data array (i.e., changing the data array), while accessing or using

data may be characterized as loading and utilizing the data in the data array in its current state. The two are distinct concepts. The cited section of Johnson does not discuss the benefits of its sorting algorithm during data access or data "use" at all. To argue that "modifying" data, allegedly necessitates and therefore is the equivalent of "accessing" or "using" data is to eviscerate the meaning of concepts and functions readily known to those of ordinary skill in the art as being separate and distinct. See Office Action dated 6/16/2006, paragraph 48.

In fact, the Johnson reference is not directed toward improving performance during data access or use at all, but rather limited to discussing improving performance during data modification. Nevertheless, the Examiner asserts:

Johnson has taught that the static sorting algorithm stores elements in reverse order, since it stands to reason that the elements first added to the array would be accessed and used before the elements most recently added to the array. (emphasis added) See Office Action, paragraph 43, lines 1-3.

Johnson has taught that entries that were placed at the beginning of an array, e.g. placed first within the array, are more likely to be accessed first, so, by placing these elements at the end of an array where there are less elements dependent on that one particular element to be made when the elements are modified, such as when Patel's instruction segments are fetched in split groups, less time is required to update the element. (emphasis added) See Office Action, paragraph 43, lines 14-18.

Applicants submit that these overbroad assertions are erroneous and unsupported by the Johnson reference. Applicants submit the related assertions based upon these interpretations of Johnson found in paragraph 43 of the Examiner are erroneous as well, and insufficient to support a proper teaching, suggestion or motivation to combine the teachings of Patel and Johnson.

The Examiner counters by citing to column 4, lines 27-29 in Johnson ("...it should be appreciated that the elements may represent practically any types of memory blocks or segments, having any fixed or variable size.") See Office Action dated 6/16/2006, paragraph 42. A generalized statement of Johnson's ability to apply its system to larger memory blocks of fixed

or variable size is not a sufficient motivation to combine when considering, as shown above, the teachings of Johnson are functionally incompatible with those of Patel. To argue that despite the fact the Johnson reference teaches away from combining with the Patel reference, one would still be motivated to combine them in such a manner is unsupported and inadequate.

The Examiner further asserts the last sentence of the cited section column 4, lines 13-24 provide the necessary motivation to combine the teachings of Patel and Johnson (citing specifically "...In general, this results in a lower average number of updated frames per data modification, and thus improved overall performance.") See Office Action dated 6/16/2006, paragraph 38. Applicant disagree, and submit a generalized statement directed toward a purported "improvement" on the prior art is not sufficient to supply a motivation to combine. Otherwise every patent application purporting to improve upon the prior art may on its face arguably offers a motivation to combine. Clearly this is not the case.

Applicants maintain that a person of ordinary skill in the art would not be motivated to reverse the instructions in a trace, while using trace packing, to improve fetch rates and that as such, claim 1 is allowable in its present form. Independent claims 5, 8 and 14 contain similar allowable limitations, and are therefore allowable for similar reasons. Claims 2-4, 7, 9-13 and 15-19 are allowable for depending from allowable base claims.

B. Claims 2, 9-11 and 16 are <u>not</u> unpatentable over Patel, Johnson and in further view of Peled.

The deficiencies are not corrected by Peled. Peled discloses a cache organized around trace segments of the running programs rather than an organization based on memory addresses. However, Peled fails to provide any motivation for modifying Patel with Johnson. Moreover,

there is no motivation disclosed to modify Patel with Johnson and Peled to arrive at the claimed invention. Accordingly, the Examiner has failed to establish a *prima facie* case of obviousness over Patel in view of Johnson in further view of Peled.

CONCLUSION

For at least these reasons, the Claims 1-19 are believed to be patentable over the cited references, individually and in combination. Withdrawal of the rejections is, therefore, respectfully requested.

Appellant therefore respectfully requests that the Board of Patent Appeals and Interferences reverse the Examiner's decision rejecting claims 1-19 and direct the Examiner to pass the case to issue.

The Examiner is hereby authorized to charge any additional fees which may be necessary for consideration of this paper to Kenyon & Kenyon Deposit Account No.

Respectfully submitted,

KENYON & KENYON LLP

Date: December 16, 2006

Sumit Bhattackarya

(Reg. No. 51,469)

Attorneys for Intel Corporation

KENYON & KENYON LLP 333 West San Carlos St., Suite 600 San Jose, CA 95110

Telephone:

(408) 975-7500

Facsimile:

11-0600.

(408) 975-7501

RECEIVED CENTRAL FAX CENTER

DEC 1 8 2006

APPENDIX

(Brief of Appellants Stephen J. Jourdan et al. U.S. Patent Application Serial No. 09/708,722)

8. CLAIMS ON APPEAL

- 1. A cache comprising:
- a cache line to store an instruction segment further comprising a plurality of instructions stored in sequential positions of cache line in reverse program order.
- 2. The cache of claim 1, wherein the instruction segment is an extended block.
- 3. The cache of claim 1, wherein the instruction segment is a trace.
- 4. The cache of claim 1, wherein the instruction segment is a basic block.
- 5. A segment cache for a front-end system in a processor, comprising a plurality of cache entries to store instructions of instruction segments in reverse program order.
- 6. Apparatus comprising:

an instruction cache system,

an instruction segment system, comprising:

a fill unit provided in communication with the instruction cache system,

the segment cache of claim 5 included therein, and

a selector coupled to an output of the instruction cache system and to an output of the segment cache.

Attorney Docket No. 2207/9800

- 7. Apparatus of claim 6, wherein the instruction segment system further comprises a segment predictor provided in communication with the segment cache.
- 8. A method comprising:

building an instruction segment based on program flow, and storing instructions of the instruction segment in a cache entry in reverse program order.

- 9. The method of claim 8, further comprising:
 building a second instruction segment based on program flow, and
 if the first and second instruction segments overlap, extending the first instruction segment to
 include non-overlapping instructions from the second instruction segment.
- 10. The method of claim 9, wherein the extending comprises storing the non-overlapping instructions in the cache in reverse program order in successive cache positions adjacent to the instructions from the first instruction segment.
- 11. The method of claim 8, wherein the instruction segment is an extended block.
- 12. The method of claim 8, wherein the instruction segment is a trace.
- 13. The method of claim 8, wherein the instruction segment is a basic block.

Attorney Docket No. 2207/9800

- 14. A processing engine, comprising:
- a front end stage to build and store instruction segments, instructions provided therein in reverse program order, and

an execution unit in communication with the front end stage.

15. The processing engine of claim 14, wherein the front-end stage comprises: an instruction cache system,

an instruction segment system, comprising:

- a fill unit provided in communication with the instruction cache system,
- a segment cache, and
- a selector coupled to an output of the instruction cache system and to an output of the segment cache.
- 16. The processing engine of claim 15, wherein the instruction segments are extended blocks.
- 17. The processing engine of claim 15, wherein the instruction segments are traces.
- 18. The processing engine of claim 15, wherein the instruction segments are basic blocks.
- 19. The processing engine of claim 15, wherein the instruction segment cache system further comprises a segment predictor provided in communication with the segment cache.

Applicatio No.: 09/708,722

Attorney Docket No. 2207/9800

Appeal Brief dated December 16, 2006

9. EVIDENCE APPENDIX

No further evidence has been submitted with this Appeal Brief.



Attorney Docket No. 2207/9800

10. RELATED PROCEEDINGS APPENDIX

Per Section 2 above, there are no related proceedings to the present Appeal.